Some Factors of Stream Bank Erosion ---and Some Questions

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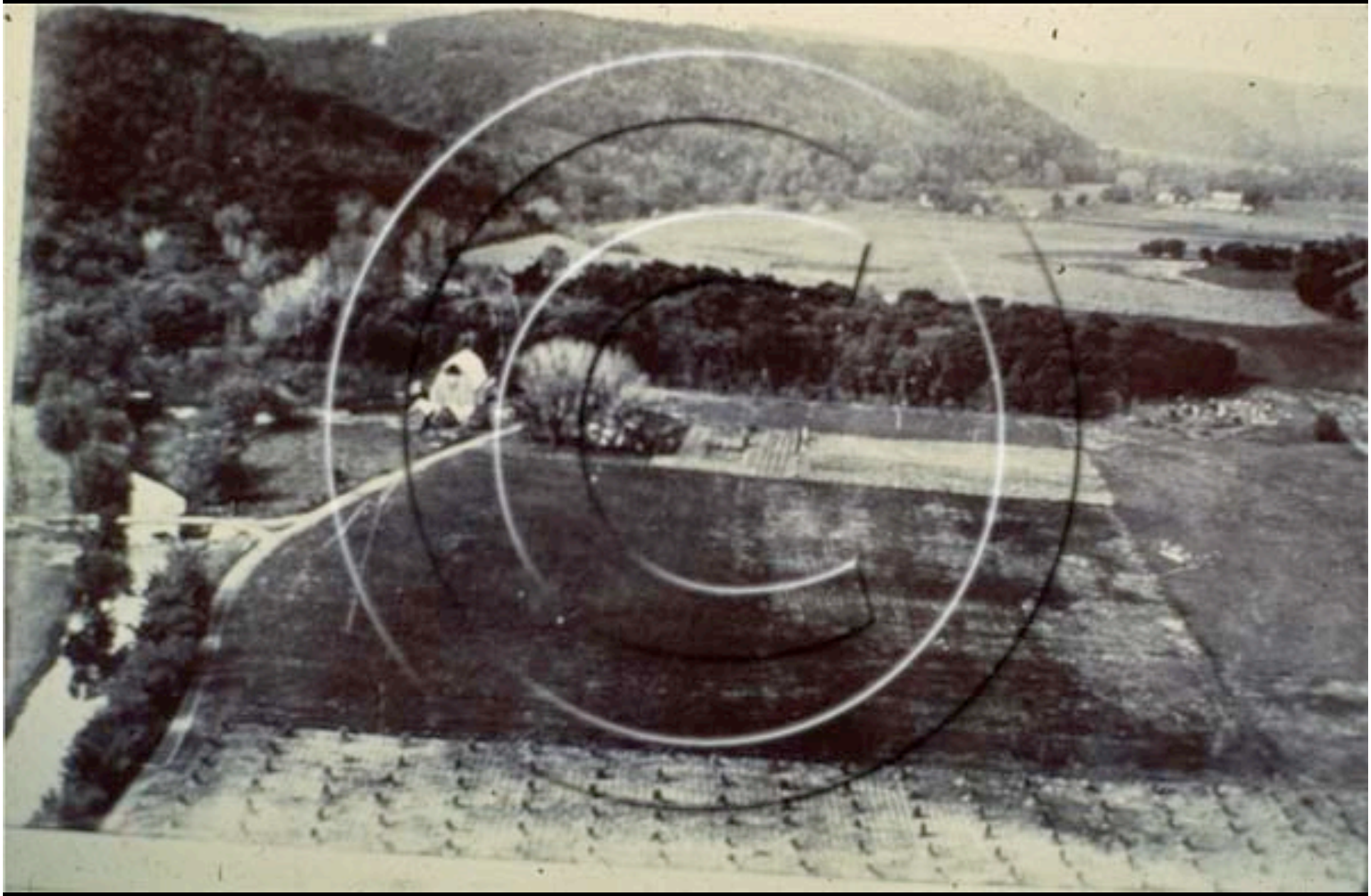
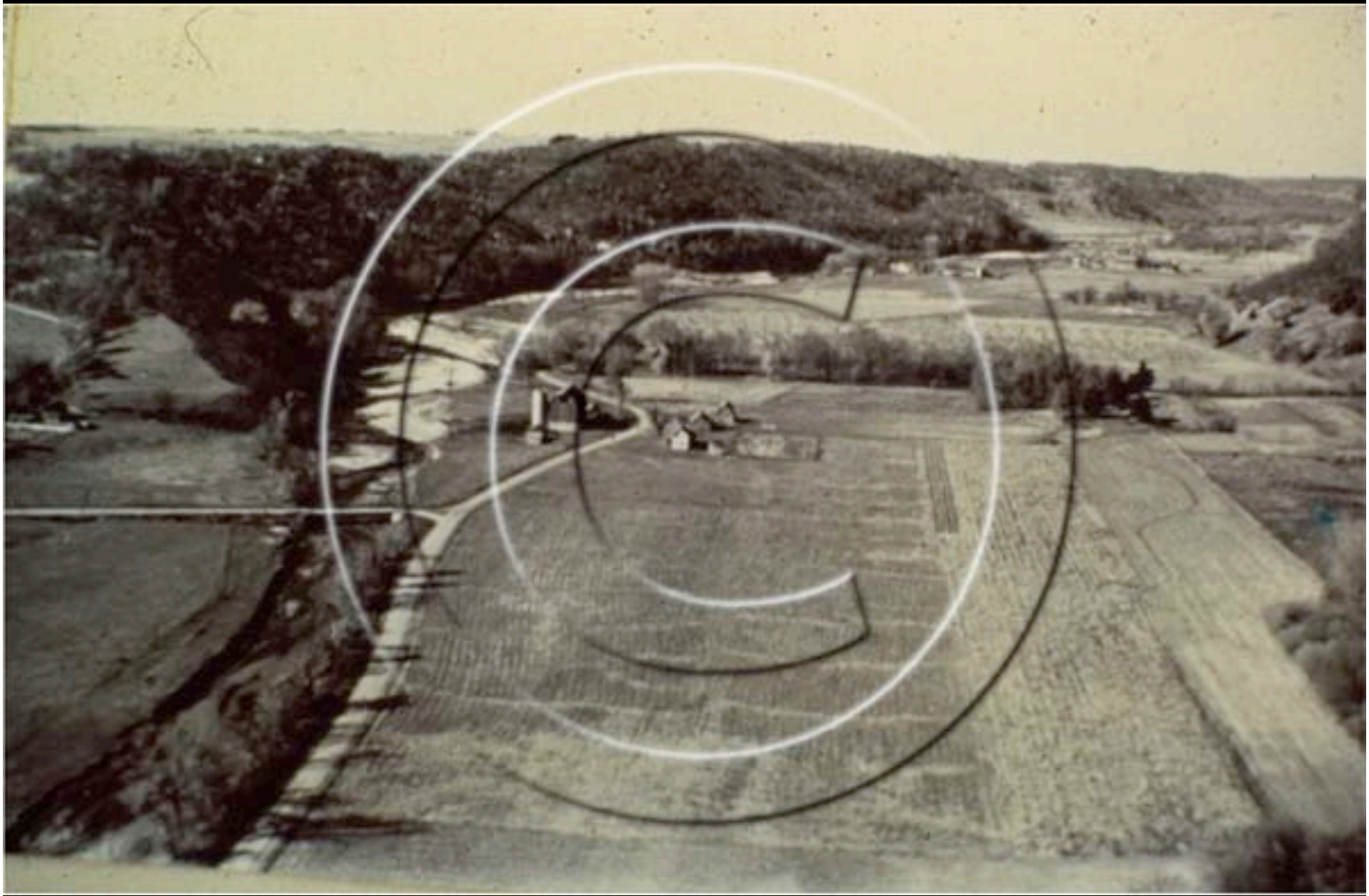
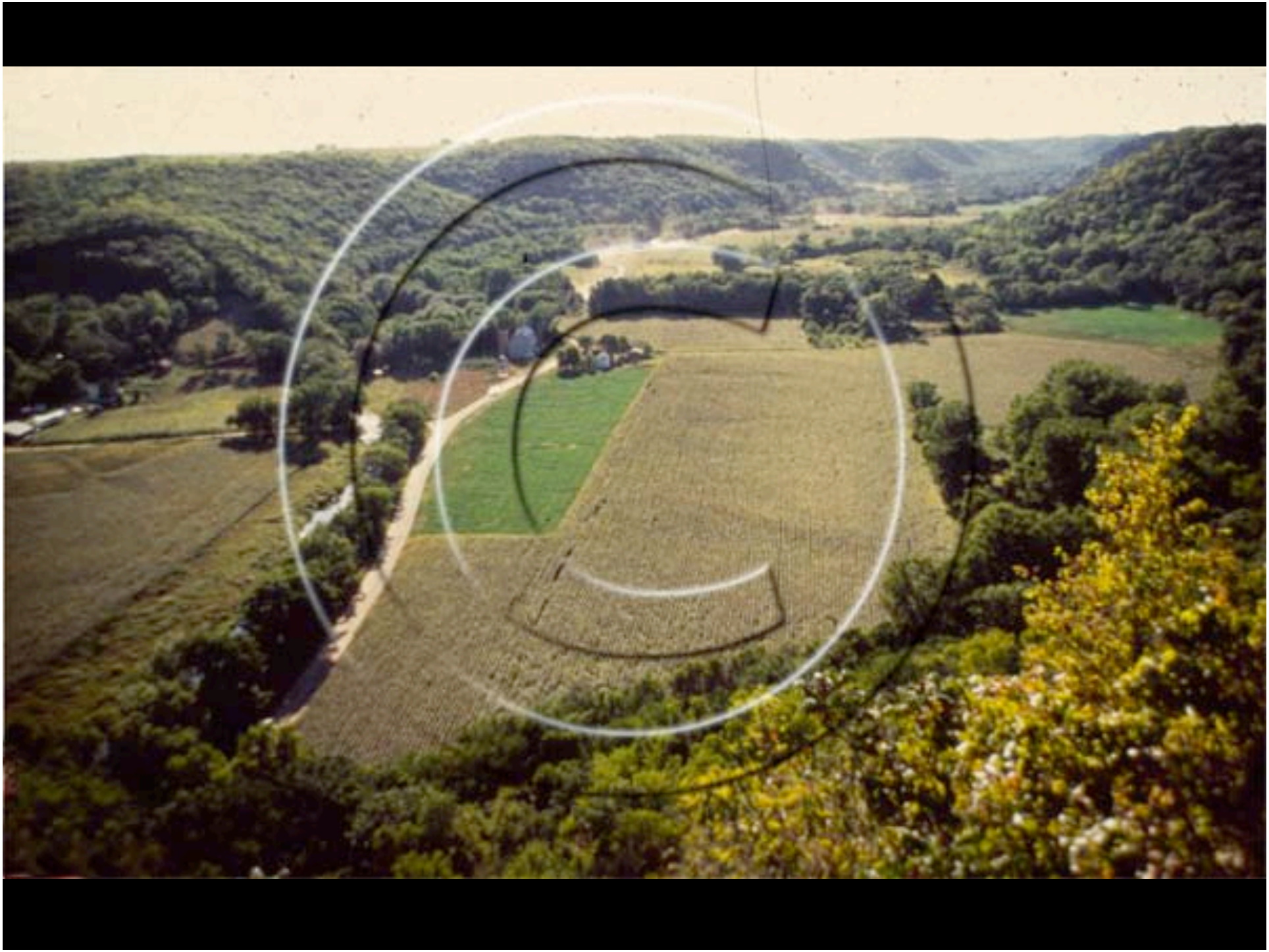
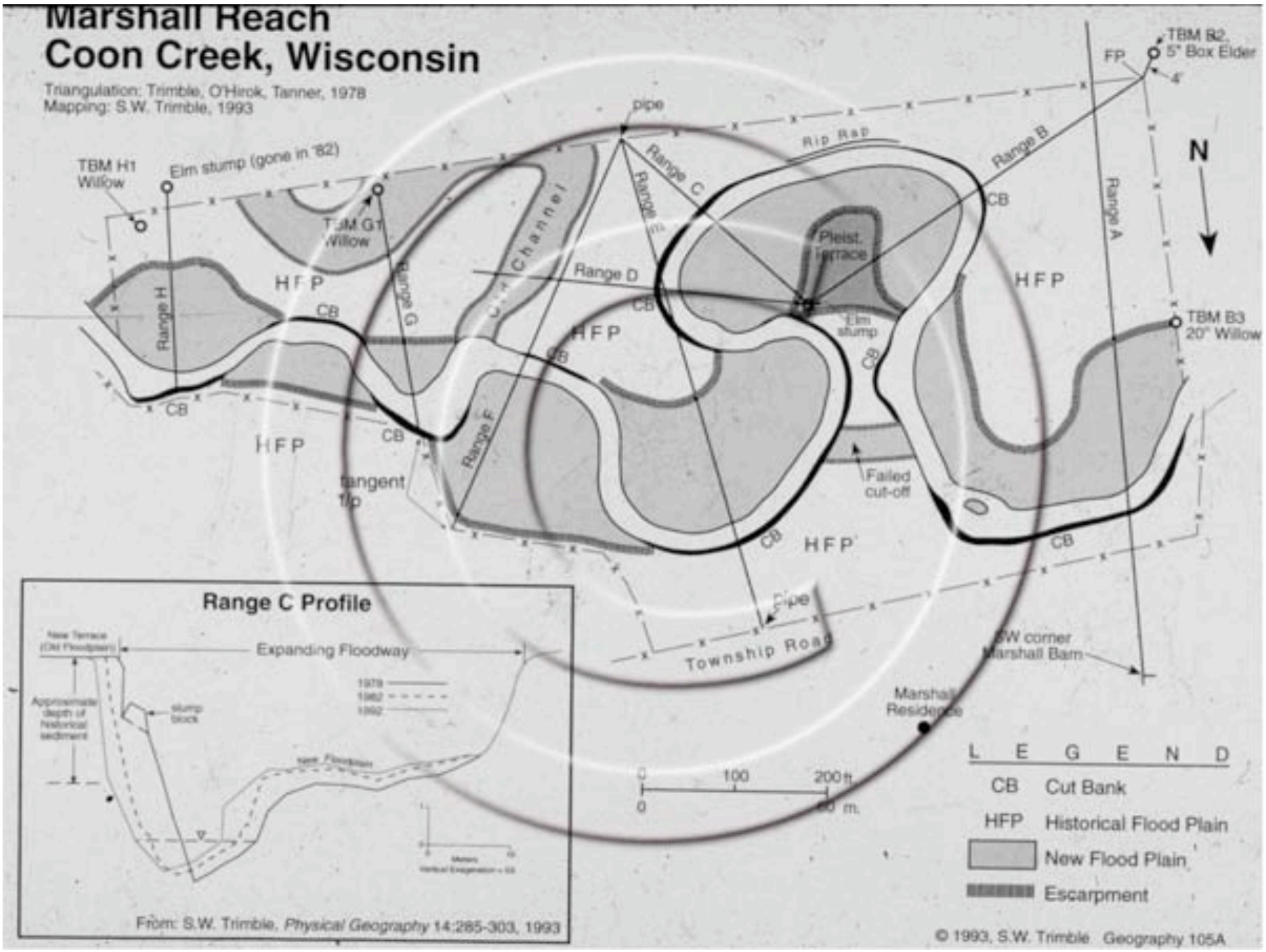






Marshall Reach
Coon Creek, Wisconsin

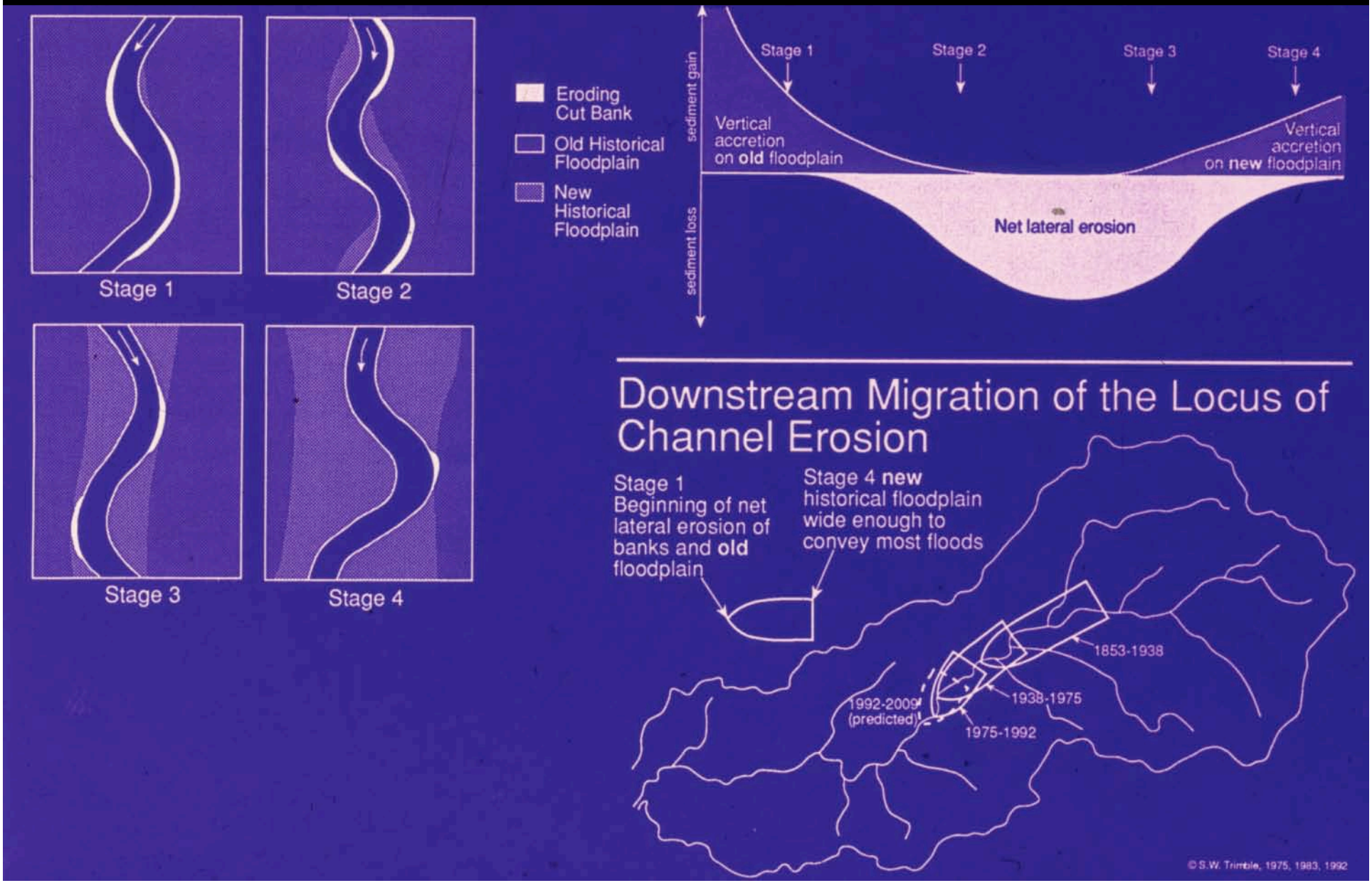
Triangulation: Trimble, O'Hirok, Tanner, 1978
Mapping: S.W. Trimble, 1993

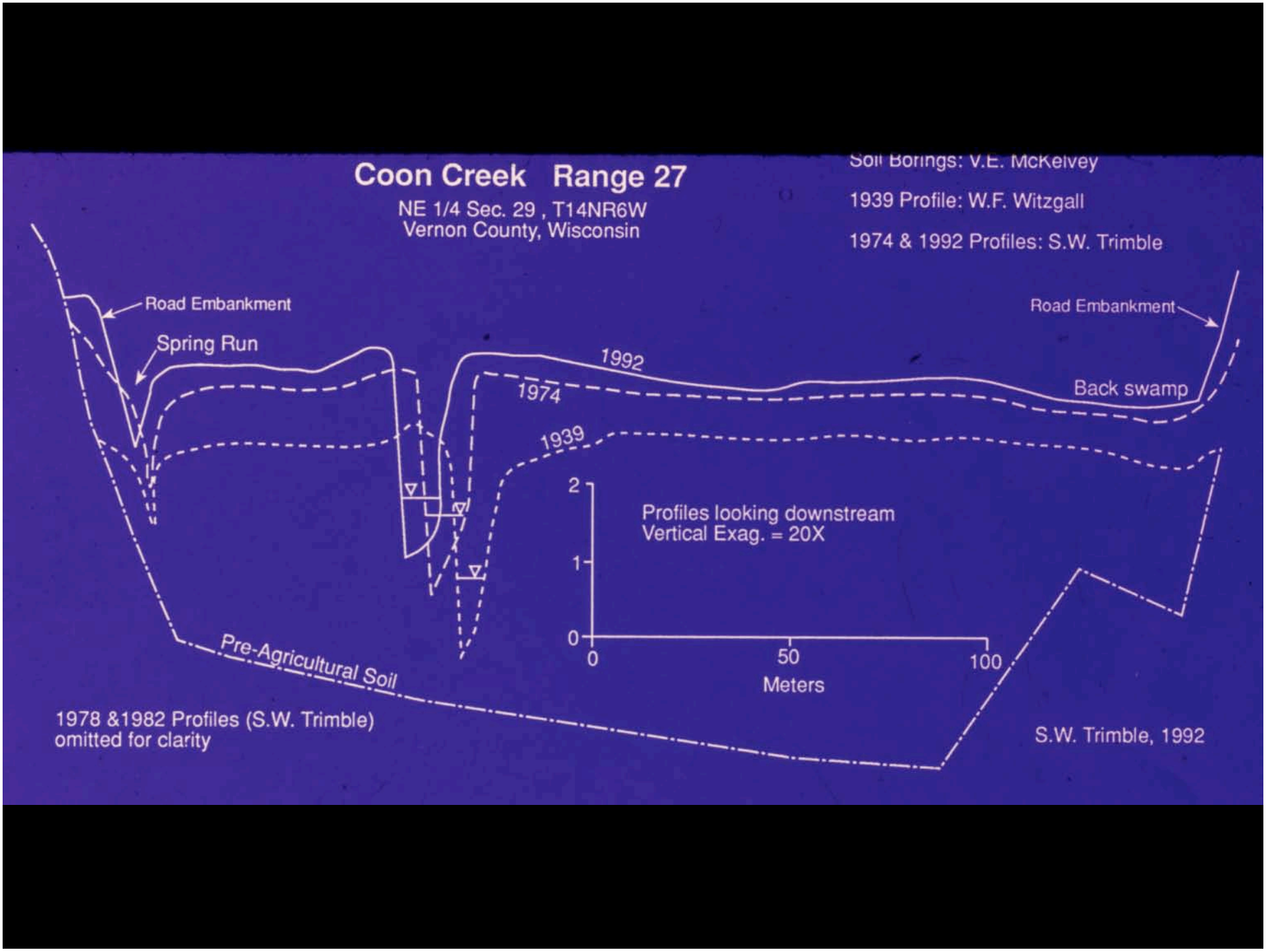


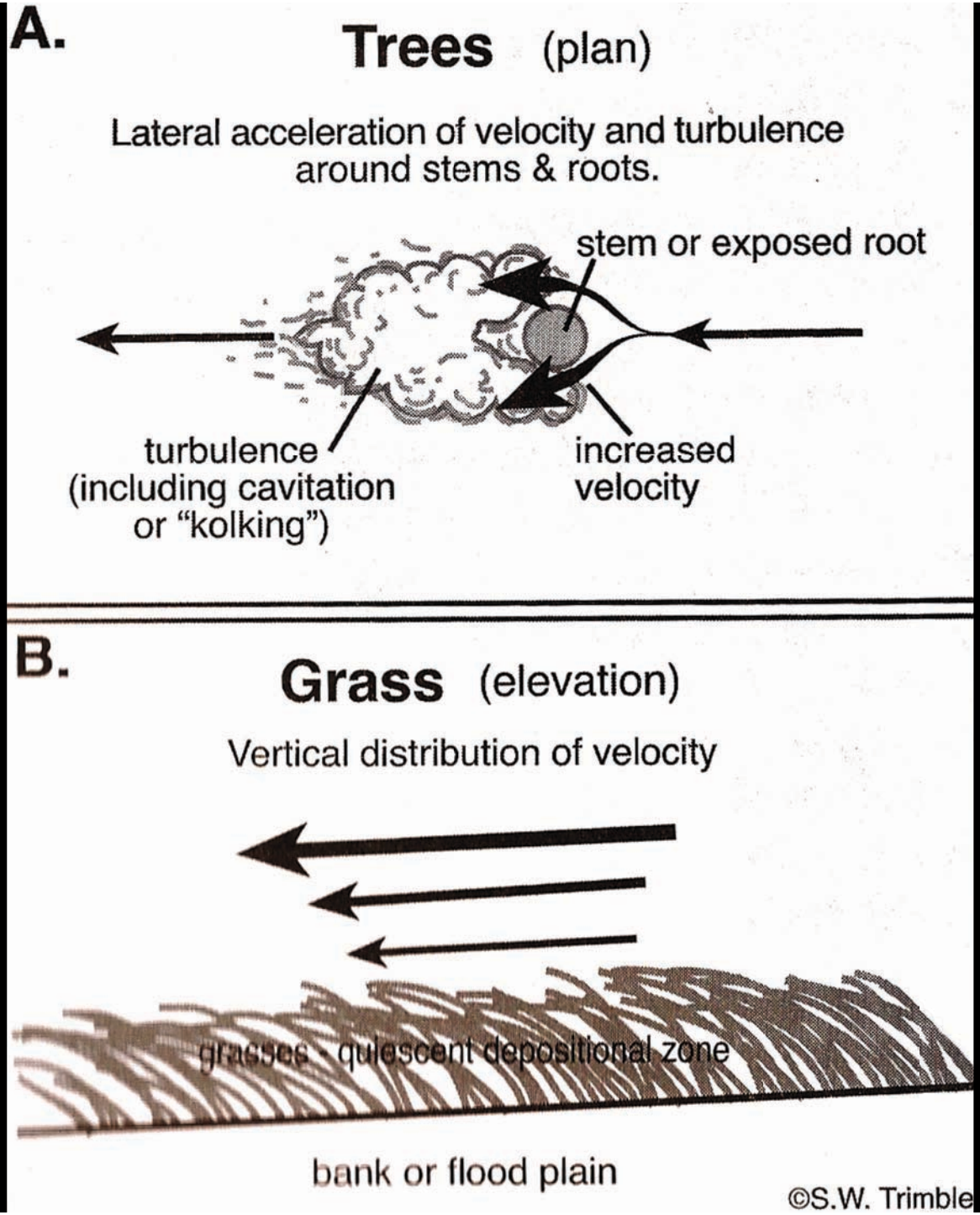
Range C Profile

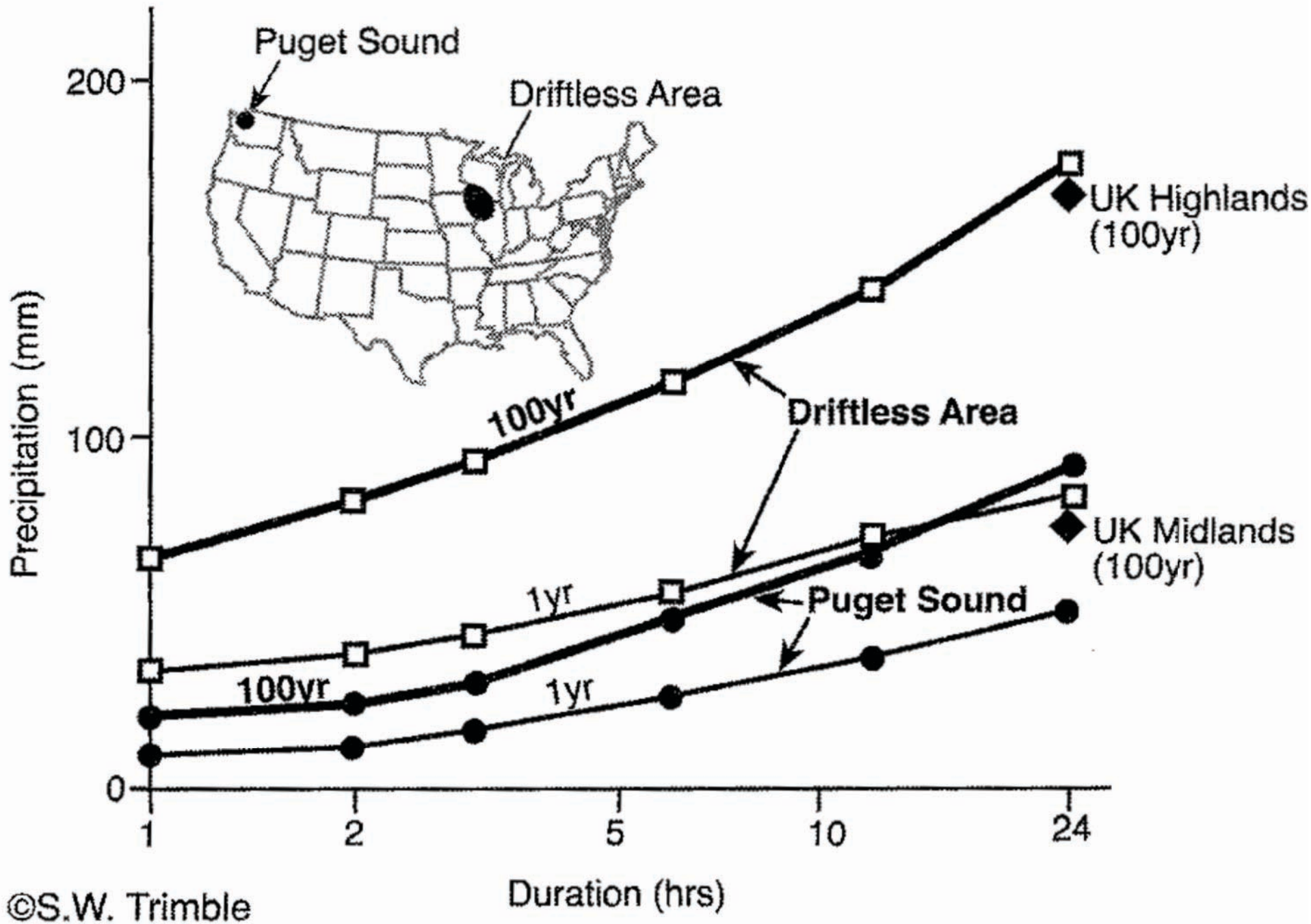
From: S.W. Trimble, *Physical Geography* 14:285-303, 1993

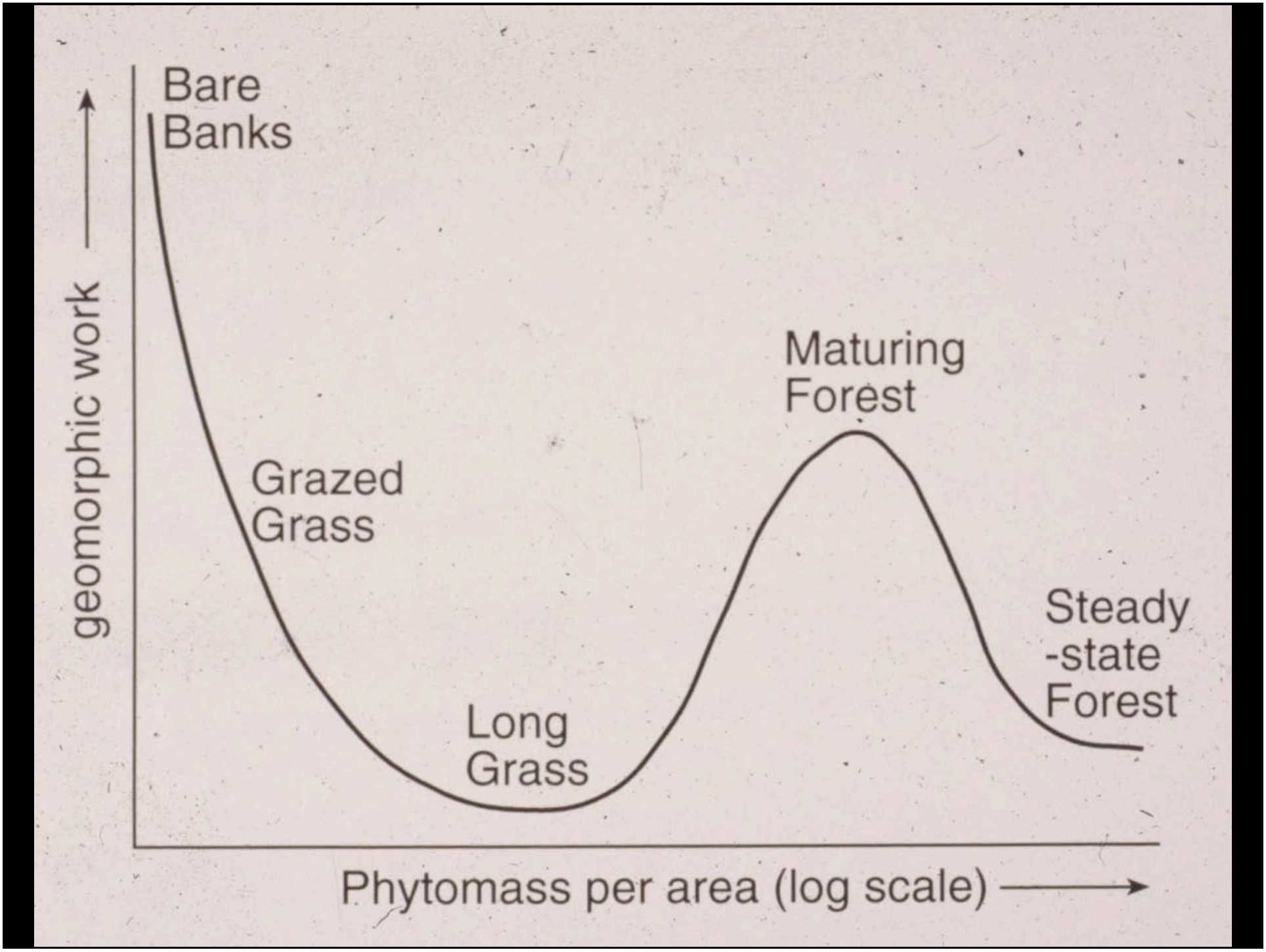
Transformation of Middle Valley Morphology and Accompanying Changes of Sediment Budget




Coon Creek Range 27
NE 1/4 Sec. 29 , T14NR6W
Vernon County, Wisconsin
Soil Borings: V.E. McKelvey
1939 Profile: W.F. Witzgall
1974 & 1992 Profiles: S.W. Trimble
Road Embankment
Spring Run
Road Embankment
1992
1974
1939
Back swamp
Profiles looking downstream
Vertical Exag. = 20X
2
1
0
0
50
100
Meters
Pre-Agricultural Soil
1978 &1982 Profiles (S.W. Trimble)
omitted for clarity
S.W. Trimble, 1992


A.
Trees (plan)
Lateral acceleration of velocity and turbulence around stems & roots.
stem or exposed root
turbulence (including cavitation or "kolking")
increased velocity
B.
Grass (elevation)
Vertical distribution of velocity
grasses - quiescent depositional zone
bank or flood plain
©S.W. Trimble


Puget Sound
Driftless Area
200
100
0
Precipitation (mm)
100yr
Driftless Area
UK Highlands
(100yr)
1yr
Puget Sound
UK Midlands
(100yr)
100yr
1yr
1
2
5
10
24
Duration (hrs)
©S.W. Trimble


Bare
Banks
Grazed
Grass
Long
Grass
Maturing
Forest
Steady
-state
Forest
geomorphic work
Phytomass per area (log scale)

TREES vs GRASS ON STREAM BANKS: SOME GEOMORPHIC CONSIDERATIONS

Stanley W. Trimble

Pre-existing Conditions:

A. Stream Channel Characteristics
1. *Width of channel*
2. *Height of banks*
3. *Strength of banks*
4. *Texture of bed materials*

B. Involved Processes
1. *Hydroclimatology and flood regime*
2. *Hydraulic scour/deposition on banks and floodplains*
3. *Mass movement of banks, temp. and water regimes*

Within the above conditions and processes:

TREES

A. Advantages:
1. *Root system-greater and deeper structural strength*
2. *Greater ET-dryer banks*

B. Disadvantages:
1. *Shade suppresses undergrowth*
2. *Exposed stems and roots enhance hydraulic scour*
3. *Mass and moment promote instability*
4. *Loss promotes instability*
   a. *LWD (climate-dependent)*
   b. *Rootwad gaps create turbulence and scour*

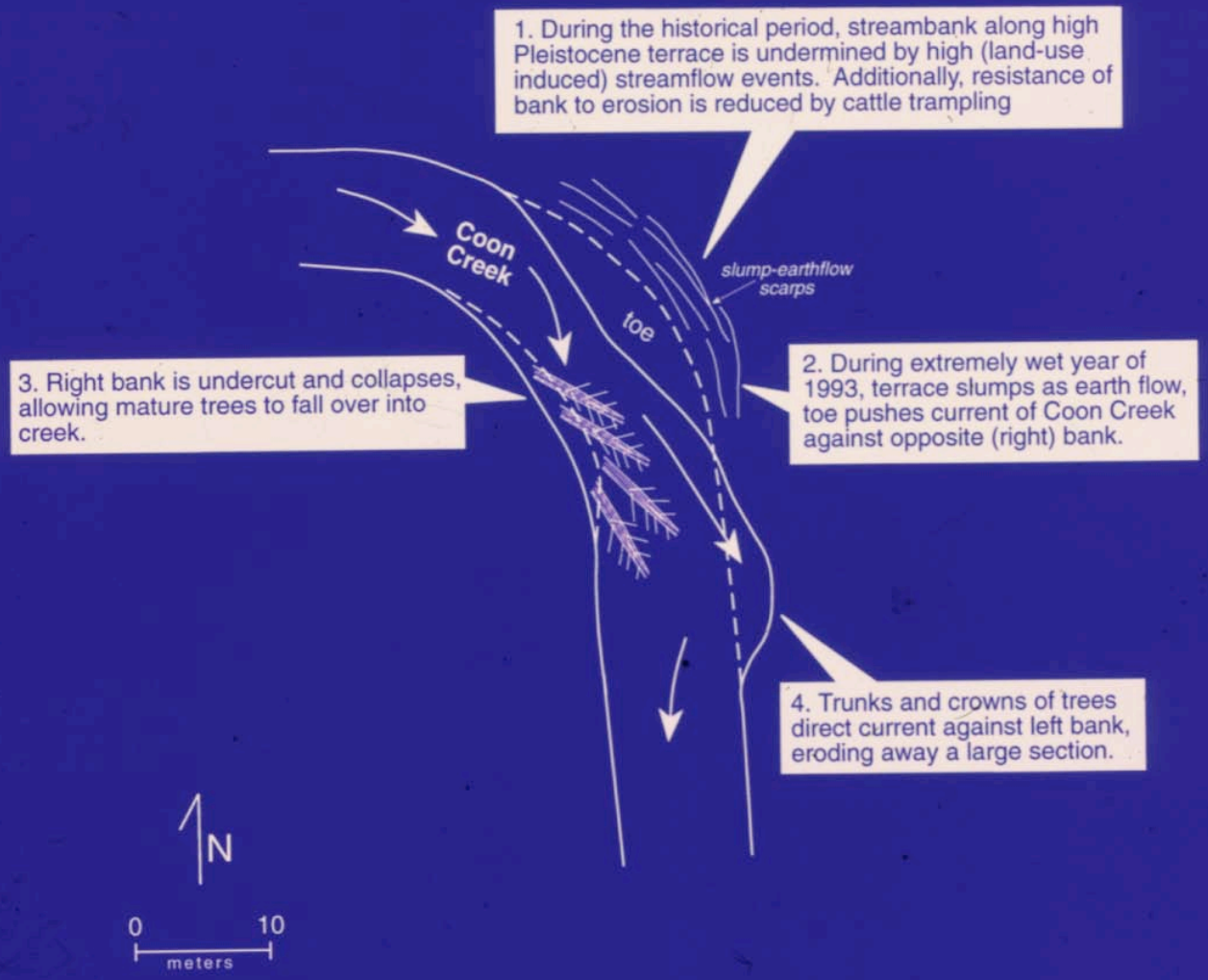
GRASS

A. Advantages:
1. *Creates"thatch", promotes vertical and lateral accretion*

B. Disadvantages:
1. *Shallow and weaker roots*
2. *Less ET, wetter banks*

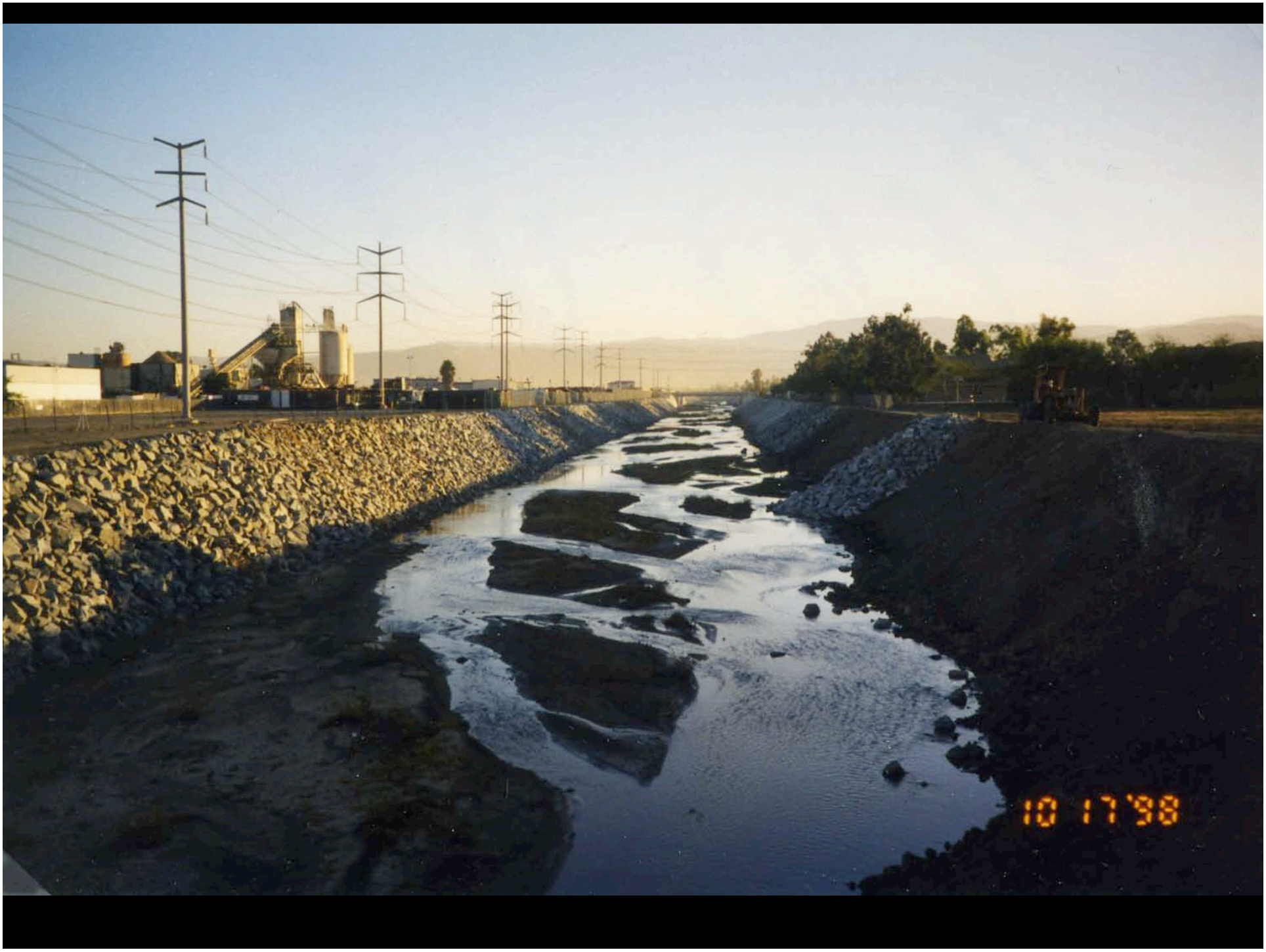
Local Stream Bank Destabilization 1993
Coon Creek Wisconsin

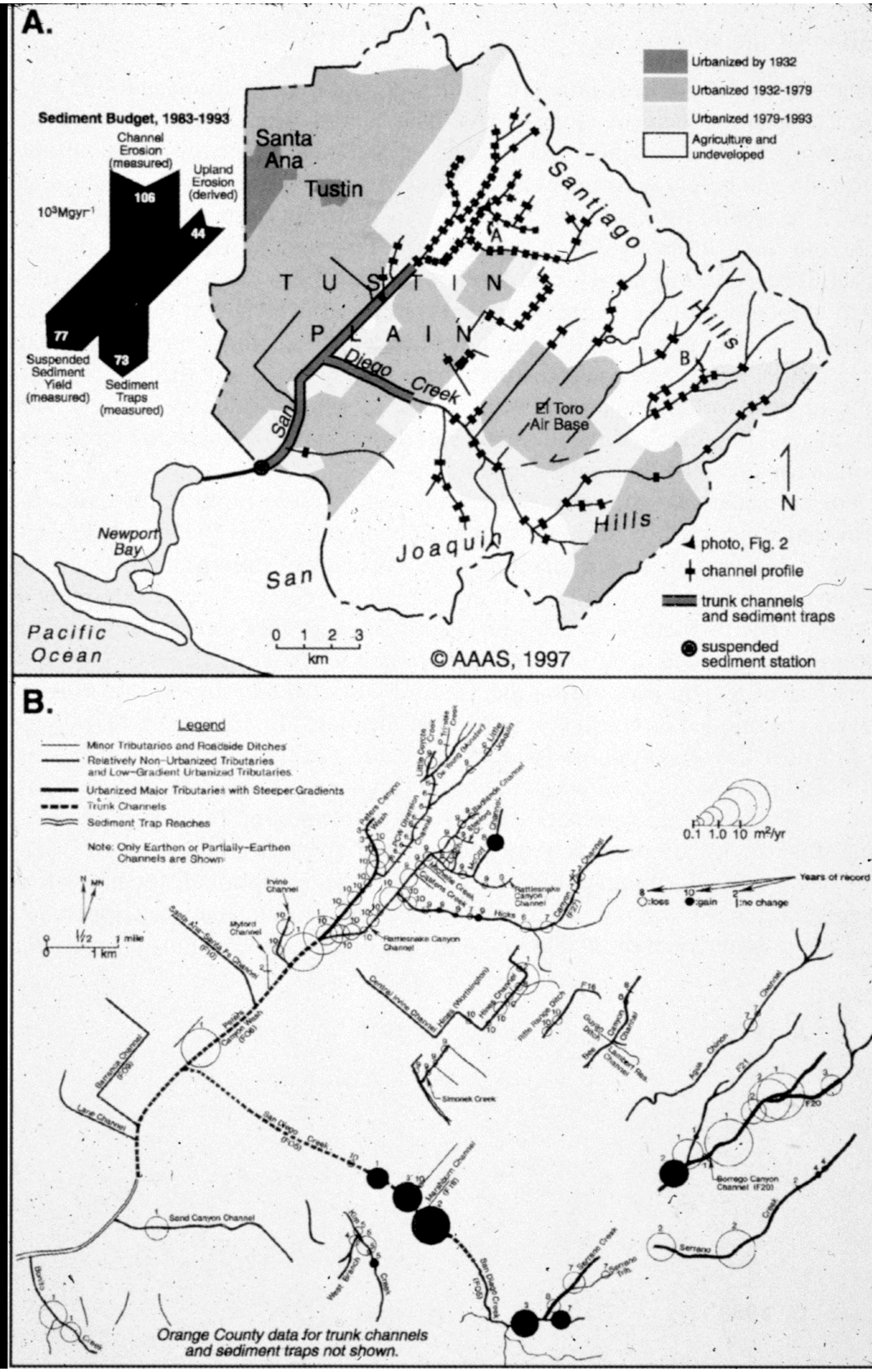
(NW1/4 Sec 30 T14N R6W, Vernon County)




Given the prevalent stream power, we've lowered the resistance by a factor of 4, so....


10


10 17'98


A.
Sediment Budget, 1983-1993
Channel Erosion (measured)
106
Upland Erosion (derived)
44
10³Mgyr⁻¹
77
Suspended Sediment Yield (measured)
73
Sediment Traps (measured)
Santa Ana
Tustin
T U S T I N
P L A I N
San Diego Creek
Santiago Hills
El Toro Air Base
San Joaquin Hills
Newport Bay
Pacific Ocean
0 1 2 3
km
© AAAS, 1997
Urbanized by 1932
Urbanized 1932-1979
Urbanized 1979-1993
Agriculture and undeveloped
N
photo, Fig. 2
channel profile
trunk channels and sediment traps
suspended sediment station
B.
Legend
Minor Tributaries and Roadside Ditches
Relatively Non-Urbanized Tributaries and Low-Gradient Urbanized Tributaries
Urbanized Major Tributaries with Steeper Gradients
Trunk Channels
Sediment Trap Reaches
Note: Only Earthen or Partially-Earthen Channels are Shown
0.1 1.0 10 m²/yr
Years of record
○:loss ●:gain |:no change
0 1/2 1 mile
0 1 km
Orange County data for trunk channels and sediment traps not shown.

Sediment Budgets for Coon Creek, Wis., 1853-1993

10^3 Mg yr^{-1}